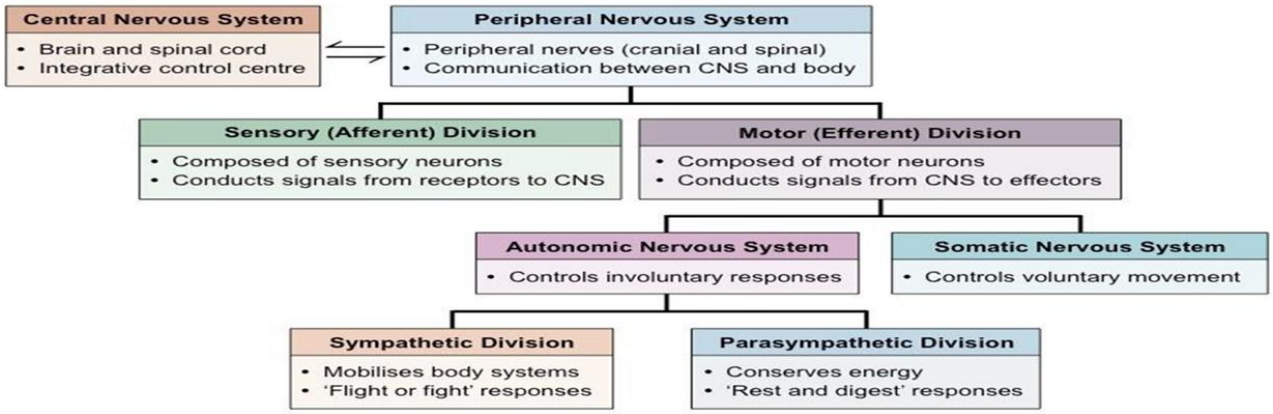
# THE NERVOUS SYSTEM


Central Nervous System
• Brain and spinal cord
• Integrative control centre
Peripheral Nervous System
• Peripheral nerves (cranial and spinal)
• Communication between CNS and body
Sensory (Afferent) Division
• Composed of sensory neurons
• Conducts signals from receptors to CNS
Motor (Efferent) Division
• Composed of motor neurons
• Conducts signals from CNS to effectors
Autonomic Nervous System
• Controls involuntary responses
Somatic Nervous System
• Controls voluntary movement
Sympathetic Division
• Mobilises body systems
• 'Flight or fight' responses
Parasympathetic Division
• Conserves energy
• 'Rest and digest' responses

- The nervous system controls bodily function by gathering sensory input, integrating that information internally, and communicating proper motor output.
- The nervous system can be divided into two major regions: the central and peripheral nervous systems.
- The central nervous system (CNS) is the brain and spinal cord, and the peripheral nervous system (PNS) is everything else.
- The brain is contained within the cranial cavity of the skull, and the spinal cord is contained within the vertebral cavity of the vertebral column. It is a bit of an oversimplification to say that the CNS is what is inside these two cavities and the peripheral nervous system is outside of them, but that is one way to start to think about it. In actuality, there are some elements of the peripheral nervous system that are within the cranial or vertebral cavities.
- The peripheral nervous system is so named because it is on the periphery—meaning beyond the brain and spinal cord. Depending on different aspects of the nervous system, the dividing line between central and peripheral is not necessarily universal.
- The nervous system is the body's main communication system; it gathers, synthesizes, and uses data from the environment.
- The most basic unit of the nervous system is the neuron, which serves as both a sensor and communicator of internal and external stimuli.

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- The nervous system can be broken down into two major parts—the central nervous system and the peripheral nervous system.
- The central nervous system, the main data center of the body, includes the brain and spinal cord.
- The peripheral nervous system includes all of the neurons that sense and communicate data to the central nervous system.
- The peripheral nervous system can be further divided into the autonomic system, which regulates involuntary actions, and the somatic system, which controls voluntary actions.

**THE CENTRAL NERVOUS SYSTEM (CNS)**

The central nervous system is made up of the brain and spinal cord, which process sensory input and provide instructions to the body.

The CNS includes the brain and spinal cord, which together comprise the body's main control center. Together with the peripheral nervous system (PNS), the CNS performs fundamental functions that contribute to an organism's life and behavior.

**Activity of the CNS**

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The nervous system has three main functions: gathering sensory information from external stimuli, synthesizing that information, and responding to those stimuli. The CNS is mainly devoted to the "information synthesizing" function. During this step in the process, the brain and spinal cord decide on appropriate motor output, which is computed based on the type of sensory input. The CNS regulates everything from organ function to high-level thought to purposeful body movement. Thus, the CNS is commonly thought of as the control center of the body.

**Structure of the Central Nervous System**

The CNS is comprised of the

1. Brain
2. Brain stem
3. Spinal cord

**1. Brain**

The brain is found in the cranial cavity and consists of the cerebrum and cerebellum. It houses the nerve centers responsible for coordinating sensory and motor systems in the body. The cerebrum, or the top portion for the brain, is the seat of higher-level thought. It is comprised of two hemispheres, each controlling the opposite side of the body.

The cerebellum is located underneath the backside of the cerebrum, and governs balance and fine motor movements. Its main function is maintaining coordination throughout the body. (Discussed in detail ahead)

**2. Brain Stem**

The brain stem is connected to the underside of the brain. It consists of the midbrain, pons, and medulla. The midbrain is found in between the hindbrain and the forebrain. It regulates motor function and allows motor and sensory information to pass from the brain to the rest of the body. The pons houses the control centers for respiration and inhibitory functions. The medulla also helps regulate respiration, as well as cardiovascular and digestive functioning.

**3. Spinal Cord**

The spinal cord is a tail-like structure embedded in the vertebral canal of the spine. The adult spinal cord is about 40 cm long and weighs approximately 30 g. The spinal cord is attached to the underside of the medulla oblongata, and is organized to serve four distinct tasks:

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- ✓ to convey (mainly sensory) information to the brain;
- ✓ to carry information generated in the brain to peripheral targets like skeletal muscles;
- ✓ to control nearby organs via the autonomic nervous system;
- ✓ to enable sensorimotor functions to control posture and other fundamental movements.

The spinal cord connects the brain and brain stem to all of the major nerves in the body. Spinal nerves originate from the spinal cord and control the functions of the rest of the body. Impulses are sent from receptors through the spinal cord to the brain, where they are processed and synthesized into instructions for the rest of the body. This data is then sent back through the spinal cord to muscles and glands for motor output.

**Structure and Function of the Brain**

The human brain is one of the most complex systems on earth. Every component of the brain must work together in order to keep its body functioning. The brain and the spinal

cord make up the central nervous system, which alongside the peripheral nervous system is responsible for regulating all bodily functions.

Psychology seeks to explain the mental processes and behavior of individuals by studying the interaction between mental processes and behavior on a systemic level. Therefore, the field of psychology is tightly intertwined with the study of the brain.

**The Structure of the Brain**

The developing brain goes through many stages. In the embryos of vertebrates, the predecessor to the brain and spinal cord is the neural tube. As the fetus develops, the grooves and folds in the neural tube deepen, giving rise to different layers of the brain. The human brain is split up into three major layers: the hindbrain, the midbrain, and the forebrain

**1. Hindbrain**

The hindbrain is the well-protected central core of the brain. It includes the cerebellum, reticular formation, and brain stem, which are responsible for some of the most basic autonomic functions of life, such as breathing and movement. The brain stem contains the pons and medulla oblongata. Evolutionarily speaking, the hindbrain contains the oldest parts of the brain, which all vertebrates possess, though they may look different from species to species.

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**2. Midbrain**

The midbrain makes up part of the brain stem. It is located between the hindbrain and forebrain. All sensory and motor information that travels between the forebrain and the spinal cord passes through the midbrain, making it a relay station for the central nervous system.

**3. Forebrain**

The forebrain is the most anterior division of the developing vertebrate brain, containing the most complex networks in the central nervous system. The forebrain has two major divisions: the diencephalon and the telencephalon. The diencephalon is lower, containing the thalamus and hypothalamus (which together form the limbic system); the telencephalon is on top of the diencephalon and contains the cerebrum, the home of the highest-level cognitive processing in the brain. It is the large and complicated forebrain that distinguishes the human brain from other vertebrate brains.

**Lower-level structures**

The brain's lower-level structures consist of the brain stem, the spinal cord, and the cerebellum.

The brain's lower-level structures consist of the brain stem and spinal cord, along with the cerebellum. With the exception of the spinal cord, these structures are largely located within the hindbrain, diencephalon (or interbrain), and midbrain. These lower dorsal structures are the oldest parts of the brain, having existed for much of its evolutionary history. As such they are geared more toward basic bodily processes necessary to survival. It is the more recent layers of the brain (the forebrain) which are responsible for the higher-level cognitive functioning (language, reasoning) not strictly necessary to keep a body alive.

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